

6-9-2016

Maternal Interactive Behaviors and Developmental Outcomes in Preschoolers Born Very Low Birth Weight

Rebecca E. Rieger

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**MATERNAL INTERACTIVE BEHAVIORS AND DEVELOPMENTAL
OUTCOMES IN PRESCHOOLERS
BORN VERY LOW BIRTH WEIGHT**

by

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BACHELORS OF ARTS

THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Master of Science

Psychology

The University of New Mexico

Albuquerque, New Mexico

May 2016

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ABSTRACT

Children born very low birth weight (VLBW) are at greater risk for cognitive and executive deficits than children born normal birth weight. One factor in development is parental wellbeing. Parents who report more depressive symptoms and lower perception of resources have poorer quality interactive behaviors. This study investigated the associations between maternal interactive behaviors during play and developmental outcomes in preschoolers born VLBW. A secondary goal was to understand the associations among maternal depressive symptoms, perception of resources, and interactive behaviors. A tertiary goal was to investigate racial and ethnic differences in maternal behaviors. Overall, one maternal behavior was negatively associated with a measure of executive functioning. Maternal depressive symptoms were negatively correlated with one maternal behavior and maternal perception of resources was negatively correlated with another maternal behavior. Additional analyses found a trend in racial and ethnic differences in attention directing behaviors between Caucasian and Native American mothers.

Keywords: Very Low Birth Weight, Child Development, Maternal Well-Being, Cross-Cultural Parenting Behaviors

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Chapter 1

Introduction

Children Born Very Low Birth Weight

Children born very low birth weight (VLBW) are surviving at higher rates than ever before, although there has been comparatively little progress in reducing the high rates of cognitive, emotional, and behavioral impairments associated with preterm birth (Aarnoudse-Mones et al., 2009; Anderson & Doyle, 2003; Conrad, Richman, Lindgren, & Nopoulos, 2009). Typically, the smaller and more premature the infant is at birth, the poorer their developmental outcomes (Schappin, Wijnroks, Uniken Venema, & Jongmans, 2013) and VLBW children tend to be 0.5 standard deviations lower in terms of their academic achievement, behavioral competencies, and executive functioning (Aarnoudse-Mones et al., 2009). Even VLBW infants with low risk of neurodevelopmental difficulties achieve lower scores than those born NBW (normal birth weight) in terms of their cognitive abilities, perceptual and motor abilities, and working memory (Caravale, Tozzi, Albino, & Vicari, 2005).

It has been proposed that together, both environmental and biological factors mediate developmental outcomes. As the child develops, the impact of medical complications may be less important than the family environment on developmental outcomes. In a group of VLBW children, Miceli et al. (2000) found that birth weight and gestational age better predicted developmental outcomes at 4 and 13 months, but by 36 months, maternal distress and social support better predicted developmental outcomes. Other factors related to poorer outcomes are various aspects of low socioeconomic status and poverty. Skills related to attention and flexibility among ethnically diverse

preschoolers were found to differ based on housing conditions, social resources, parental occupation, and family composition (Segretin et al., 2014).

Parental Interactive Behaviors

Young children develop primarily in the context of early parent-child relationship and interactions. This relationship represents a complex series of interactions between parent and child that are shaped by the history of their relationship and maintained by their day-to-day contact. Caregivers can support and foster children's development in a number of ways, including structuring play, offering reciprocal communication, providing emotional support, and supplying cognitive stimulation. As children age, their cognitive abilities mature and become more complex. Parental guidance that support these developing skills make it more likely that their children will continue to learn efficiently and effectively (Taylor, Anthony, Aghara, Smith, & Landry, 2008).

One aspect of the family environment that consistently facilitates more optimal outcomes is responsive parenting, which can be assessed through a number of different positive parenting behaviors (Taylor et al., 2008). Positive maternal interactive behaviors during play have been found to predict better emotional regulation in emotionally reactive infants (Ursache, Blair, Stifter, Voegtline, & The Family Life Project Investigators, 2013). Maternal responsiveness at both 9 and 13 months predicted achievement of child language skills more so than the child's own behaviors (Tamis-LeMonda, Bornstein, & Baumwell, 2001).

Parental interactive behaviors vary in relation to their child's developmental competencies, not just between child to child and across ages, but across context as well. Li, Pawan, and Stansbury (2014) found that mothers modulate their support during play

based on prior knowledge of their children's self-regulatory capacities. However, mothers of children with developmental risk show less sensitivity during more demanding parenting tasks, such as folding a specific paper airplane or building a Lego tower from directions, when compared with mothers of typically developing children (Ciciolla et al., 2013).

The impact of maternal directiveness also changes over time. Directiveness has been found to positively support cognitive development at 24 months but by 40 months has a direct, negative influence on the child's cognitive and social independence. Therefore, directiveness should ideally decrease in relation to the child's developing competencies (Landry et al., 2000).

Maternal attention directing behaviors. Maternal support for a child's focus of attention is thought to facilitate higher levels of self-regulation as well as learning because it provides a structure for the child's developing skills (Vygotsky, 1978). Maintaining attention during play, as opposed to redirecting, supports the child's developing skills as it does not necessitate a shift in the child's attentional focus (Tomasello & Farrar, 1986). Parents who utilize this type of sensitive input are better able to guide and structure interactions, allowing their child to eventually take a more active role and, eventually, assume regulation of his or her own behaviors (Tomasello & Farrar, 1986). Maternal maintaining has been found to relate to greater child vocabulary development (Akhtar, Dunham, & Dunham, 1991) and greater object exploration (Landry, Garner, Swank, & Baldwin, 1996).

The positive effects of maternal maintaining behaviors have been found in infants. Even at six months of age, medically high-risk VLBW infants whose mothers use more

attention-maintaining behaviors during play had better developmental outcomes, especially expressive language (Smith et al., 1996). In a study investigating the relation of change in maternal interactive types to the development of social competence in VLBW children, mothers who showed higher levels of maintaining across 6 to 40 months had children who displayed greater increases in initiating in daily activities (Landry, Smith, Miller-Loncar, & Swank, 1998).

Mothers who engage in more maintaining behaviors have VLBW and NBW children who exhibit better cognitive and language skills at 24 and 40 months (Landry et al., 2000). In addition, these maternal maintaining behaviors support later child independence at 48 months. Landry et al. (1996) also found that the complexity of child's play was more likely to increase following requests where mothers maintained, rather than redirected, their child's attention. In other research studies, redirecting was considered to be a behavior indicative of a lack of responsiveness on the part of the mother (Landry, Smith, & Swank, 2006).

Cognitive Development

Children born VLBW are at risk for a number of difficulties related to their academic achievement and executive functioning. Although some individual studies report that these problems decrease as the child ages, a number of notable meta-analyses have found these difficulties to be stable during development and to persist into young adulthood (Aarnoudse-Moens et al., 2009). The extent to which VLBW children differ in their cognitive and behavioral performance has been found to be directly in proportion to the birth weight as well as gestational age (Bhutta, Cleves, Casey, Craddock, & Anand, 2002). Although the findings are not consistent, some researchers have found sex

differences in developmental outcomes, with girls performing better than boys (Aylward, 2002). In a meta-analysis of individual variability in neurocognitive performance from childhood into young adulthood, younger girls initially performed better than boys but by young adulthood females and males performed the same (Roalf et al., 2014).

Although cognitive abilities and executive functioning are measured and analyzed discretely, in reality these skills often overlap. For example, children's verbal abilities have been found to significantly predict increases in effortful control, which indicates that verbal regulation of behavior may be a critical component of the development and maintenance of self-control (Lengua, Honorado, & Bush, 2006).

Cognitive Abilities. Intelligence, or broad cognitive development and skills, taps into general skills related to the child's understanding of the world, communication, learning, problem solving, and abstract thought. These skills are typically assessed through a number of tasks that tap verbal and performance based skills. Children born VLBW typically score around 0.5 standard deviations lower than the mean on tasks related to cognitive abilities (Aarnoudse-Moens et al., 2009). Even those VLBW children not at high risk for difficulties score lower than NBW children (Caravale et al., 2005). These deficits in cognitive abilities are typically related to other difficulties as well, such as problems with behavior and academic achievement. Parental interactive behaviors may also play a role, as maternal responsiveness during the first year of life has been shown to predict achievement of child language milestones (Tamis-LeMonda et al., 2001).

Executive Functioning. Executive functioning (EF) refers to higher order, self-regulatory cognitive skills that aid in the ability to monitor and control thought and

action. This constellation of skills includes ability to maintain attention, impulse control, working memory, planning, emotional regulation, and cognitive flexibility that are necessary for independent, purposeful and goal-directed activities (Carlson, 2005). Therefore, EF plays a profound part in terms of future academic and behavioral competencies.

Deficits related to EF have long been recognized in VLBW children. These deficits cannot fully be explained after taking intelligence into account (Caravale et al., 2005). In a meta-analysis of neurobehavioral outcomes in VLBW school aged children, moderate to severe deficits were identified in terms of attention problems (Aarnoudse-Mones et al., 2009). Anderson and Doyle (2003) found significantly lower scores on a number of tasks assessing executive functioning behaviorally as well as cognitively in eight-year-old children born VLBW. They also found that children born at lower birth weights (500 to 749 grams) had worse outcomes than those born relatively higher birth weight (750 to 999 grams). However, even VLBW children with a low risk of neurodevelopmental deficits achieve lower scores related to EF than NBW (Caravale et al., 2005).

Often EF difficulties are very interrelated, particularly among preschoolers born VLBW. Witt et al. (2014) found a link between VLBW preschoolers' ability to self-regulate and their behavioral responses in emotional situations. In terms of emotional reactivity and regulation, they showed negative affect behaviors when faced with fear and frustration-eliciting situations. In addition, poorer inhibition skills were related to more intense emotional reactions as well as lower regulation skills. Emotional skills were found to have a discontinuous developmental trajectory in these children as they

continued to age, which highlights the continued need for monitoring of development over time (Witt et al., 2014).

Parental Wellbeing and Child Outcomes

As young children primarily develop in the context of their parent(s), it is important to understand the impact that parental wellbeing can have on child outcomes. This parent-child relationship can serve as a major source of support or stress for preschool age children (Treyvaud et al., 2011). Poorer parental wellbeing, as measured by the parent's depressive symptoms, limited perception of resources and support, and stress related to the parenting role, is associated with worse quality of parent-child interaction, which in turn elevates the probability of difficulties in children (Choe et al., 2013). Children born VLBW are already at risk for poor outcome (Aarnoudse-Moens et al., 2009) and are more sensitive to these poorer parenting behaviors than children born NBW (Landry et al., 2000). In addition, these parental difficulties often co-occur and amplify poor parenting behaviors, placing these children at further risk, which is often called the family stress model (Leinonen, Solantaus, & Punamaki, 2002; Parke et al., 2004). One illustration of this complex relationship is a study that found a relationship among depressive symptoms, marital problems, hostile parenting, and child adjustment using structural equation modeling (Parke et al., 2004). Another example is a study's findings that maternal post-natal depressive symptoms were related to lower cognitive functioning among infants whose mothers reported low perceived social support (McManus & Poehlman, 2012).

Maternal depressive symptoms. Symptoms of depression are relatively common among mothers of young children that can have serious consequences for child

development. Mothers of children born VLBW were found to have more depressive symptoms than mothers of children born NBW (Howe, Sheu, Wang, & Hsu, 2014). In a meta-analysis investigating the relationship between maternal depressive symptoms, parenting behaviors, and child outcomes, Lovejoy, Graczyk, O'Hare, and Neuman (2000) found that maternal depressive symptoms were associated with more negative maternal behaviors as well as disengagement from the child. Depressed mothers were also less likely to have positive parenting behaviors; although these effects were largest in mothers who were currently depressed, they found apparent residual effects of prior depressive symptoms (Lovejoy et al., 2000).

Poor parental wellbeing during early childhood has been associated with poor behavioral outcomes in children born VLBW. Huhtala et al. (2012) assessed both maternal and paternal depressive symptoms, parenting stress, and sense of coherence at two years and parental perception of their child's behavior at three years. The poorer the psychological wellbeing of mothers, fathers, or both parents at two years, the more behavioral and emotional problems the VLBW child exhibited, as reported by parents, at age three. This early exposure can have long-lasting repercussions. Early exposure to maternal symptoms of anxiety and depression at 18 months predicted later depressive symptoms more than exposure to these maternal symptoms in preadolescence (Nilsen, Gustavson, Roysamb, Kjeldsen, & Karevlod, 2013). These long-term effects of maternal difficulties early in life highlight vulnerable periods in childhood.

Maternal social support. A mother's perception of her access to and satisfaction with resources is important to her wellbeing, parental behaviors, and subsequent child developmental outcomes. Social support is the perception of relational provisions in

terms of attachment, social integration, opportunity for nurturance, a reassurance of worth, a sense of reliable alliance, and the obtaining of guidance (Aktan, 2012). In pregnant and postpartum women, social support is inversely related to anxiety, which indicates a potential buffering effect of social support on psychological distress (Aktan, 2012). Mothers of children born VLBW tend to report higher social isolation and less social support than mothers of children born NBW when the child was 24 months old (Howe et al., 2014). In addition, higher levels of perceived social support had a dampening effect of parenting stress on positive parent-child interactions in low SES families (McConnell, Breitzkreuz, & Savage, 2010). Perceived parental social support seems to be particularly important early in the child's development, indicating the sensitivity of young children born VLBW (McManus & Poehlman, 2012).

Cultural considerations in parental behavior. As social interactions and family have a significant influence on child development from birth, it is important to consider cultural differences in parent-child interactions. Some cultures may not emphasize or define play in the same way as Western cultures, a consideration in cross-cultural research (Gauvain, 1995). Children from diverse backgrounds, such as non-Western or lower socioeconomic backgrounds, may not have the same opportunities for play that children from Western and higher socioeconomic status do (Goncu & Mosier, 2000). In addition, the preferred type of play may differ by culture, guided by socialization values such as a preference for self-reliance and independence, as valued by individuals from Caucasian descent, or an emphasis on a more supportive and interdependent family, as valued by individuals from Hispanic descent. For example, within play interactions, Hispanic mothers have been found to utilize more visual cues, directives, and modeling

behaviors compared to Caucasian mothers, who tend to rely on praise and verbal inquiries (Zayas & Solari, 1994).

At-risk families. Ethnically diverse families generally come from lower socioeconomic backgrounds and may experience additional stressors related to their minority status (Leinonen et al., 2002; Parke et al., 2004). Families with lower educational attainment and income have been found to endorse more depressive symptoms and less positive parenting in terms of sensitivity, structuring, and intrusiveness during play (Emmen et al., 2013). In another study investigating these factors, McConnell et al. (2010) found that, while family income and parent education attainment predicted parenting stress and child developmental difficulties, financial hardship did not fully explain the influence of educational attainment. It may be that parents with higher education are better able to seek out parenting information and other helpful resources than parents with less education (McConnell et al., 2010).

If these parents face multiple difficulties, which is often the case, these problems can be conceptualized together as a cumulative risk. Lengua et al. (2006) found that minority status, poverty, single-parent status, household density, adverse life events, and symptoms of maternal depression were related to worse parenting behaviors (less warmth, limit setting, and scaffolding, and more negative affect). These risk factors are also associated with poorer effortful control and lower social competence in young children, which set the child up poorly to handle difficulties they encounter as they develop (Lengua et al., 2006).

Lower SES is associated with more negative outcomes among VLBW children than among NBW children (Liaw & Brooks-Gunn, 1994). There may be differential

associations between maternal interactive behaviors and child outcomes based on SES (Westbrook & Harden, 2010). For example, children from higher SES families who have fewer mother-initiated task changes obtained the most optimal verbal visual-spatial processing scores compared to lower SES families, but children who have fewer mother-initiated task changes in lower SES families do not show the same developmental benefits (Dilworth-Bart, Poehlmann, Miller, & Hilgendorf, 2010). Therefore, mothers who initiate fewer task changes during unstructured play in higher SES homes may be facilitating their children's skill development, whereas this association may not be present in lower SES homes (Dilworth-Bart et al., 2010).

Chapter 2

Methodology

Hypotheses

A primary goal of this study was to investigate the associations between maternal interactive behaviors during play and developmental outcomes in preschoolers born VLBW. A secondary goal of this study was to understand the associations among maternal depressive symptoms, perception of resources, and interactive behaviors. A tertiary goal was to compare Hispanic, Caucasian, and Native American mothers' amount of redirect behaviors during play. As SES is well known contributors to poorer outcomes, maternal education as a SES index was taken into account. Hypotheses included:

- 1) Positive attention directing behaviors (introduce and maintain) during play as measured by the Maternal Attention Directing Manual (Landry et al., 2002) would be positively correlated with child developmental outcomes as measured by VIQ, PIQ, Bear Dragon, and Gift Delay.
- 2) Negative attention directing behaviors (redirect and disengaged) during play would be negatively correlated with child developmental outcomes.
- 3) Associations between maternal depressive symptoms on the Beck Depression Inventory (BDI), maternal resources as measured by the Personal Resource Questionnaire (PRQ), and maternal attention directing behaviors (introduce, maintain, redirect, and disengaged) were examined, with the prediction that more positive attention directing behaviors would be correlated with fewer depressive symptoms and greater perceived resources; and more negative attention direction

behaviors would be correlated with more depressive symptoms and fewer perceived resources.

- 4) It was predicted that Hispanic mothers would exhibit significantly more redirect behaviors than Caucasian and Native American mothers.

Methods

Sample and participant selection. Participants included 78 children between the ages of 3 and 4.5 years and their mothers. The children were born between April 2006 and November 2010. To be eligible for the research study, the children had to be born VLBW, which meant birth weight of ≤ 1500 grams or gestational age < 32 weeks. Children were excluded if they were exposed to illicit substances prenatally, had vision or hearing impairment, or a genetic abnormality.

The University of New Mexico's Human Research Review Committee reviewed and provided approval for this research study, which was in compliance with institutional research standards for human research. To recruit VLBW participants, pediatric nurses and Special Baby Clinic coordinator from the University of New Mexico Hospital (UNMH) identified eligible participants. Caregivers who expressed interest in the study were provided a description of the study and were scheduled for an assessment. Graduate students then contacted the caregivers of the eligible preschoolers to provide a brief description of the study and schedule an assessment if mothers and children were interested in participating in the research study.

All caregivers were informed of all aspects and aims of the study before they provided informed consent at the start of their scheduled assessment prior to

participation. Videotape of the maternal-child play interaction, as well as preschooler's cognitive and EF abilities were conducted at the MIND Research Network in Albuquerque, NM. Medical information was obtained for the VLBW cohort through hospital record access and review.

Measures

Sociodemographic variables. Demographic data collected includes family income, number of family members living in the home, maternal education, and ethnicity of child and caregiver. Caregivers indicated income by selecting one of eight choices for annual household income: 1) from \$0 to \$10,000, 2) income between \$10,001 and \$20,000, 3) income between \$20,001 and \$30,000, 4) income between \$30,001 and \$40,000, 5) income between \$40,001 and \$50,000, 6) income between \$50,001 and \$60,000, 7) income between \$60,001 and \$70,000 and, 8) income greater than \$70,000. Maternal education was indicated as one of four different choices: 1) less than 12th grade or high school graduate, 2) any college coursework, 3) a Bachelor's degree, or 4) some graduate school or higher.

Overall cognitive score. To assess the child's overall cognitive abilities, the Wechsler Preschool and Primary Scale of Intelligence-III (WPPSI-III, Wechsler, 2002) will be used. This test is appropriate for children 30 months of age to 7 years. It includes a number of tasks, which are summed and calculated in Verbal (VIQ) and Performance (PIQ) scores.

Executive Functioning

Inhibitory control. To assess the child's ability to inhibit their responses, the Gift Delay task was used (Carlson, 2005). The experimenter says that she has a gift for the

child but the child has to wait for the experimenter to wrap the gift then make a card for the child. The child is asked to leave the table and look at the wall while the experimenter wraps the gift. Once the experimenter wraps the gift, the child can return to the table but cannot touch the gift while the experimenter makes the child a card. The experimenter wraps the gift for 60 seconds and makes the card for 60 seconds, for a total of 120 seconds in all. The child was coded for the time it took to turn around to see what the experimenter was doing, touch the wrapped present, or tried to open it. The measurement of interest is the amount of time it took for the child to turn around or peek.

Cognitive flexibility. To assess the child's inhibition abilities, the Bear Dragon test was used (Kochanska, Murray, Jacques, Koenig, & Vandegest, 1996). In this task, children alternated between performing and suppressing commanded actions. The experimenter introduced the child to a nice bear puppet, whose directions they should follow, and a naughty dragon puppet, whose directions they should not follow. The experimenter then practiced these instructions, giving the child commands from each of these puppets and provides feedback to ensure the child understood before proceeding to the actual task. The measurement of interest was the number of correct responses the child provided before he or she made four consecutive mistakes.

Maternal Questionnaires

Maternal resources. The Personal Resource Questionnaire (PRQ; Weinert, 2003) was used to assess the perceived level of social support and the degree of satisfaction with the help received. Respondents were asked to rate each statement on a 7-point response scale and the responses were summed to get a total score.

Maternal depression. The Beck Depression Inventory – II (BDI – II; Beck, Steer, & Brown, 1996) was used to indicate the occurrence and severity of symptoms of depression over the last two weeks. Respondents were asked to rate each statement on a four-point response scale and the responses were summed to get a total score.

Parent-Child Videotaped Play.

Attention directing behaviors. Child and mother dyads were videotaped for 10 minutes with a standard set of toys including pretend food, a cash register and blocks. Five minutes of the videotaped mother-child interaction was coded, as this ensured that all tapes had an equal amount of coded time when the mother and child were actively engaged in play and the research assistant was not present. Mothers were coded for the timing of their behavior in terms of maintaining the current activity with their child, introducing a new activity, or redirecting to a new activity (Landry et al., 1998). The engagement of the child was coded as well, as either actively engaged in play with their mother, actively engaged in independent play, or not actively engaged. Maintain occurred when the mother is facilitating the child's active attention, such as playing with or commenting on the toy with which the child was playing. Introduce occurred when the mother presented a new object or conversation when the child was not actively attending. Redirecting attention occurred when the child was actively involved with something else and the mother tried to introduce a new toy or game and shift the child's attention away from the current activity. Both mother and child each have one code for every second of the five-minute segment coded and all mother and child codes were mutually exclusive. For all mother and child codes, each behavior will have two numbers. One calculation

was the total times that the behavior occurred over the 300 seconds. The other calculation was the total number of seconds spent over 300 seconds for a given behavior.

Data Analysis

All measures were inspected for distribution normality. Results of this screening indicated distributions had significant skewness and kurtosis. Therefore, Spearman correlations were used to investigate the relationship between maternal attention directing behaviors and child developmental outcomes. Outcome variables included WPPSI-III VIQ and PIQ scores, the Bear Dragon score, and Gift Delay score. Analyses by hypotheses are as follows:

- 1) Spearman partial correlations were used to determine the strength of the relationship between percent of positive maternal attention directing behaviors (introduce and maintain) and child developmental outcomes (VIQ and PIQ scores, the Bear Dragon score, and Gift Delay score) for all participants. Maternal education and child test age were used as covariates.
- 2) Spearman partial correlations were used to determine the strength of the relationship between percent of negative maternal attention directing behaviors (redirecting and disengaged) and child developmental outcomes (VIQ and PIQ scores, the Bear Dragon score, and Gift Delay score) for all participants. Maternal education and child test age were used as covariates.
- 3) Spearman partial correlations were used to determine the strength of the relationship between maternal depressive symptoms, maternal perception of resources, and maternal attention directing behaviors (introduce, maintain, redirect, and disengage). Maternal education was used as a covariate.

- 4) An ANOVA was used to compare three groups (Hispanic, Caucasian, Native American) on maternal redirecting behaviors. Additional t-tests examined contrasts between two ethnic groups on redirecting behavior.

Chapter 3

Results

Demographic descriptives for all the study participants are presented in Table 1. Differences between the groups include: Caucasian mothers had significantly higher education and income than Native American and Hispanic mothers. The groups did not significantly differ on child sex, birth weight, or gestational age. In the following analyses, maternal education was used as a covariate to account for the influence of socioeconomic status. While income would have been another potential covariate to account for socioeconomic status, maternal education and income are highly correlated ($r = .454, p < .001$), and since maternal education has been used as a SES index in this population previously (Lowe et al., 2014), maternal education was selected as the SES proxy covariate in the current study.

Table 1
Demographic descriptives of participants

	Range or Frequency (%)	Mean	SD
Maternal Age (years)	18-48	32.1	7.4
Maternal Education*			
<High school	5 (6%)	2.0	1.2
High school degree	23 (30%)		
Some college	36 (46%)		
≥ College degree	14 (18%)		
Family Income per Year**			
<10,000	10 (13%)	3.0	2.3
10,000-20,000	13 (17%)		
20,000-30,000	20 (25%)		
30,000-40,000	8 (10%)		
40,000-50,000	4 (5%)		
50,000-60,000	8 (10%)		
60,000-70,000	2 (3%)		
>70,000	13 (17%)		
Race/Ethnicity			
Caucasian	21 (27%)		
Hispanic	35 (45%)		
Native American	17 (22%)		
African American	5 (6%)		
Sex of Child			
Male	41 (53%)		
Female	37 (47%)		
Age of Child (months)	36-59	46.7	5.0
Gestational age at birth (weeks)	22-34	29.0	2.2
Birth weight (grams)	600-1688	1146.8	264.0
*Maternal Education: 0 = <High school, 1 = High school degree, 2 = Some college, 3 = ≥ College degree.			
**Family Income per Year: 0 = <10,000, 1 = 10,000-20,000, 2 = 20,000-30,000, 3 = 30,000-40,000, 4 = 40,000-50,000, 5 = 50,000-60,000, 6 = 60,000-70,000, 7 = >70,000.			

Descriptives of child performance on these developmental outcomes are presented in Table 2. The WPPSI-III (Wechsler, 2002) is a well-validated measure of IQ in young children. The reported VIQ and PIQ scores are consistent with past literature, which has shown that children born VLBW tend to score 0.5 standard deviations below the mean on

tasks related to IQ and cognitive abilities (Aarnoudse-Moens et al., 2009). The Bear Dragon (Kochanska et al., 1996) and Gift Delay (Carlson, 2005) are tasks that were adapted in our research lab, so the means and standard deviations of these tasks are consistent with past literature in preschoolers born VLBW (Lowe et al., 2014).

Table 2

Descriptives of child developmental outcomes and maternal questionnaires

	Range	Mean	SD
WPPSI-III Verbal IQ	68-131	93.63	13.2
WPPSI-III Performance IQ	63-123	90.7	12.8
Bear Dragon	0-33	16.8	12.6
Gift Delay	1-60	36	23.3
BDI - II	0-25	7.1	6.2
PRQ	15-105	89	14.9
<i>Note.</i> WPPSI-III = Wechsler Preschool and Primary Scale of Intelligence-Third Edition; BDI – II = Beck Depression Inventory – II; PRQ = Personal Resource Questionnaire.			

Descriptives of maternal attention directing behaviors and child behaviors are presented in Table 3 and descriptives of child behaviors are presented in Table 4. The descriptives of these behaviors are difficult to place in the current research as there are limited studies published that looked at attention directing behaviors (Landry et al., 1998) and these research studies do not consistently use the same amount of time to score parent and child play. The current study used five minutes of play and another study used ten minutes of play (Landry et al., 2000). In addition, this other study just looked at number of times that the mother maintained over a ten-minute period and did not measure total duration of maintaining behavior.

Table 3
Descriptives of maternal attention directing behaviors

	Range	Mean	SD
Introduce Number	0-2	.29	0.5
Introduce Time	0-18	1.5	1.5
Maintain Number	1-10	3.6	1.7
Maintain Time	172-300	282	20.4
Redirect Number	0-9	2.3	1.6
Redirect Time	0-39	9.6	7.2
Disengage Number	0-4	.3	.9
Disengage Time	0-132	6.9	23.4
Note. Behaviors from Attention Directing Behaviors (Landry et al., 1998); Number = Number of times the behavior was present; Time = Total time spent on that behavior.			

Table 4
Descriptives of child behaviors

	Range	Mean	SD
Child Active Play with Mom Number	1-7	1.8	1.2
Child Active Play with Mom Time	132-300	284	28.2
Child Active Play with Self Number	0-7	0.9	1.3
Child Active Play with Self Time	0-169	13	25.8
Child Disengaged Number	0-1	0.01	.11
Child Disengaged Time	0-1	0.01	.11
Note. Behaviors from Attention Directing Behaviors (Landry et al., 1998); Number = Number of times the behavior was present; Time = Total time spent on that behavior.			

The first hypothesis investigated the strength of the relationships between positive maternal attention directing behaviors, specifically introduce and maintain, and child developmental outcomes, VIQ, PIQ, Bear Dragon score, and Gift Delay score, among all participants. First, we ran a Spearman correlation and then ran a Spearman partial correlation, controlling for maternal education and child test age. In contrast to our hypothesis, with maternal education and child test age as covariates, no significant

correlations were found between introduce and maintain maternal behaviors and child developmental outcomes using either a Spearman correlation or a Spearman partial correlation. See Table 5.

Table 5

Spearman partial correlations between positive maternal attention directing behavior and child developmental outcomes

	Introduce Number	Introduce Time	Maintain Number	Maintain Time
WPPSI-III Verbal IQ	.113	.322	.087	-.006
WPPSI-III Performance IQ	.141	.125	-.119	.085
Bear Dragon	-.028	-.023	-.092	.172
Gift Delay	-.041	.041	-.047	.162

Note. Number = Number of times the behavior was present; Time = Total time spent on that behavior; WPPSI-III = Wechsler Preschool and Primary Scale of Intelligence-Third Edition.
* $p < .05$ ** $p < .01$

Our second hypothesis investigated the strength of the relationships between negative maternal attention directing behaviors, specifically redirect and disengage behaviors, and child developmental outcomes, VIQ, PIQ, Bear Dragon score, and Gift Delay score, among all participants. Partially in line with our hypothesis, using Spearman correlations, we found that the number of times disengaged ($r = -.224, p = .049$) and total time spent disengaging ($r = -.232, p = .041$) were significantly negatively correlated with the Bear Dragon. After controlling for maternal education and child test age, the number of times disengaged ($r = -.246, p = .032$) and total time spent disengaging ($r = -.253, p = .027$) were still significantly correlated with the Bear Dragon. No other significant relationships between negative maternal attention directing behaviors and child developmental outcomes were found. Results are presented in Table 6.

Table 6

Spearman partial correlations between negative maternal attention directing behavior and child developmental outcomes.

	Redirect Number	Redirect Time	Disengage Number	Disengage Time
WPPSI-III Verbal IQ	.110	.161	-.214	-.201
WPPSI-III Performance IQ	-.150	-.219	.014	.031
Bear Dragon	-.056	.106	-.246*	-.253*
Gift Delay	.054	-.063	-.204	-.212

Note. Number = Number of times the behavior was present; Time = Total time spent on that behavior; WPPSI-III = Wechsler Preschool and Primary Scale of Intelligence-Third Edition.
* $p < .05$ ** $p < .01$

Our third hypothesis investigated the strength of the relationships between maternal depressive symptoms, maternal perception of resources, and maternal attention directing behaviors (introduce, maintain, redirect, and disengage). Descriptives of maternal depressive symptoms and perception of resources are presented in Table 2. Partially in line with our hypothesis, using Spearman correlations, we found that number of times disengaged ($r = -.321, p = .012$) and total time spent disengaged ($r = -.331, p = .010$) were negatively correlated with perception of resources. When controlling for maternal education, we found that number of times disengaged ($r = -.323, p = .013$) and total time spent disengaged ($r = -.332, p = .010$) were still negatively correlated with perception of resources. In addition, when controlling for maternal education, we found that number of times mothers introduced new activities ($r = -.278, p = .025$) and total time spent introducing new activities ($r = -.261, p = .036$) were negatively correlated with maternal depressive symptoms. No other significant relationships were found among depressive symptoms, perception of resources, and attention directing behaviors. Results are presented in Table 7.

Table 7

Spearman partial correlations between maternal attention directing behavior, depressive symptoms, and perception of resources

	Introduce (#/Time)	Maintain (#/Time)	Redirect (#/Time)	Disengage (#/Time)
BDI – II	-.278*/-.261*	.080/.003	.125/.153	-.006/-.021
PRQ	.153/.168	-.073/.123	.003/.039	-.323*/-.332**
<p><i>Note.</i> BDI – II = Beck Depression Inventory – II; PRQ = Personal Resource Questionnaire. # = Number of times the behavior was present; Time = Total time spent on that behavior. *$p < .05$ **$p < .01$</p>				

Our fourth hypothesis predicted that there would be more maternal redirecting behaviors among Hispanic mothers than among Caucasian or Native American mothers. Contrary to our hypothesis, we found that there were no group differences in maternal redirecting behaviors. On average, Caucasian mothers used the most redirecting behaviors and Native American mothers used the least number of redirecting behaviors. Results are presented in Figure 1 and 2.

Figure 1
Comparison of maternal redirecting behavior (number) between Caucasian, Hispanic, and Native American mothers

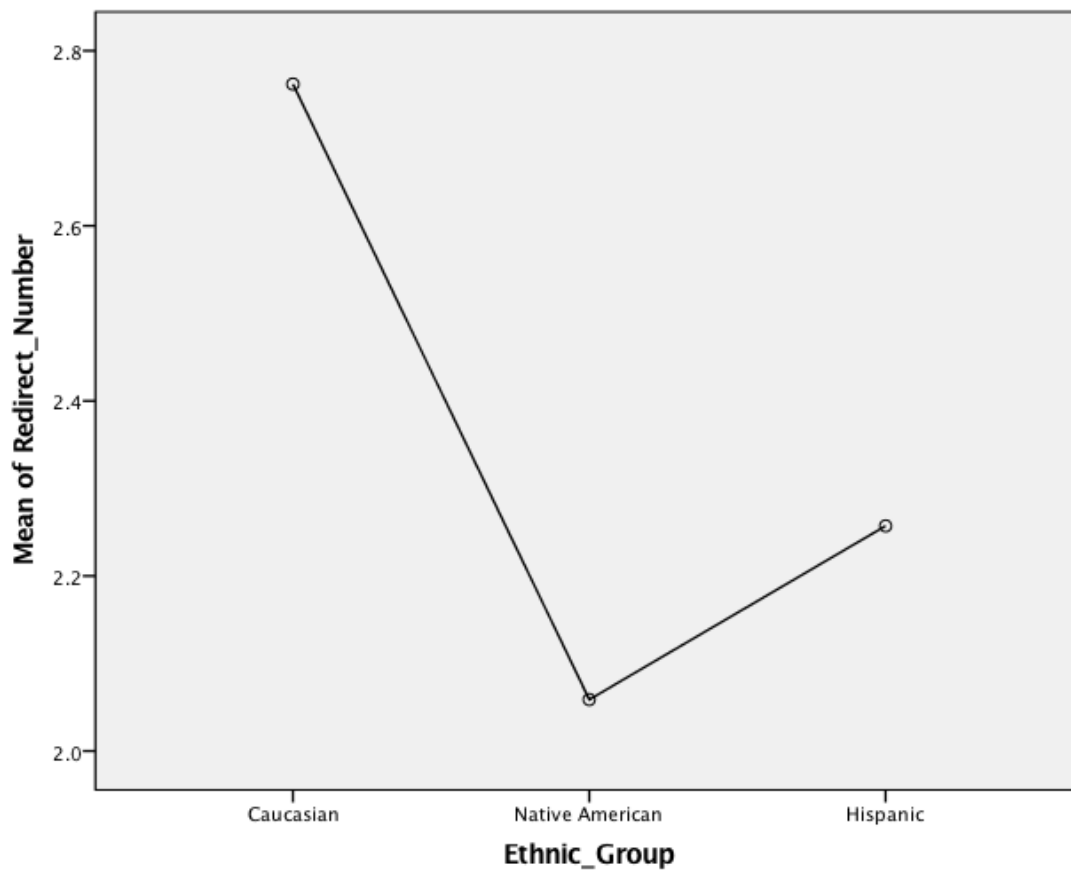
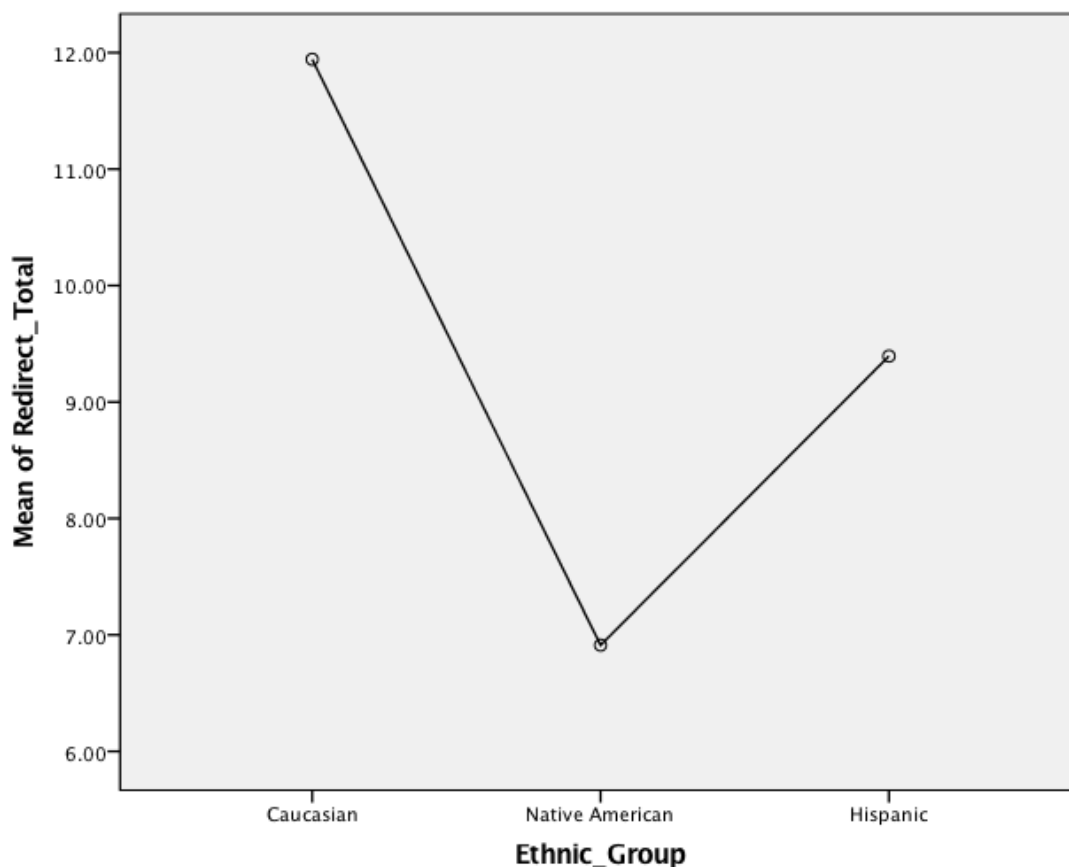


Figure 2

Comparison of maternal redirecting behavior (total time) between Caucasian, Hispanic, and Native American mothers



To further investigate racial and ethnic differences, mean plots were inspected for the non-significantly different redirecting behaviors between Hispanic, Caucasian and Native American mothers. As Caucasian mothers used the most redirecting behaviors and Native American mothers used the least number of redirecting behaviors, a post hoc t-test compared Caucasian and Native American mothers. While not statistically significant, we found a trend that the Caucasian mothers spent more total time redirecting than Native American mothers $t(36) = 2.03, p = .05$. Another post hoc test compared Caucasian and Hispanic mothers on redirecting behaviors using a t-test and found no

significant group difference.

Post hoc tests added further investigated to the planned analyses. To investigate dyad engagement, a composite measure of child and mother behaviors was created in order to address the variability within the maintaining behavior category. Specifically, we observed that sometimes during play, the child would lose interest in what the mother was doing (and the child and mother were formerly doing together) and would play by him or herself. Since the mother was still technically “maintaining”, this mother would continue to be coded as “maintaining”. However, since the child was no longer engaged in that play, he or she would no longer be coded as engaged with mother. A dyad engagement measure was created, subtracting child play with self from total time mother spent engaging in maintaining behavior to get a more accurate measure of mother and child engagement during play. To see if there were any associations with child developmental outcomes (VIQ, PIQ, Bear Dragon score, and Gift Delay score), this measure of engagement was correlated with these outcome measures using Pearson correlations with maternal education and child test age as covariates. Consistent with other findings in this study, this measure of dyad engagement was positively associated with Bear Dragon ($r = .252, p = .034$) but no other child developmental outcomes.

Chapter 4

Discussion

Summary

The primary aim of this study was to investigate the relationships between maternal interactive behaviors and child developmental outcomes, specifically cognitive abilities and executive functioning (cognitive flexibility and inhibitory control), in preschoolers born VLBW. The study also investigated associations between maternal interactive behaviors, depressive symptoms and perception of resources. In addition, ethnic differences on redirecting behaviors were examined between Caucasian, Hispanic, and Native American mothers. Post hoc analyses investigated associations between dyadic engagement and developmental outcomes. Overall, we found that of the four maternal attention directing behaviors (introduce, maintain, redirect, and disengaged) and the four outcome variables, the only significant association was a negative one between the number of times the mothers disengaged as well as the total time spent disengaged and the Bear Dragon.

Discussion of the Results

In examining the associations between maternal interactive behaviors and child developmental outcomes, we found that the cumulative amount of time the mother spent disengaged and the total number of times the mother disengaged during play were significantly negatively correlated with the Bear Dragon executive function (EF) score, which is a verbally laden task that measures cognitive flexibility. By disengaging from play entirely, the mother does not provide her child with any structure or guidance. Therefore, the child is left to play alone without any support, which may limit the

repertoire of the child's play as well as the child's ability to stay engaged with a task. No other associations were found between maternal attention directing behaviors and child developmental outcomes. In particular, maternal introduction of new toys or games during play was not found to be associated with any child outcomes. It was hypothesized that this behavior would have positive associations with verbal, perceptual, and executive functioning as introducing a game or toy when a child is not actively involved in a task could indicate more attunement between a mother and her child. This kind of attendance to the child's cues has been targeted in interventions aimed to facilitate responsive parenting in at-risk preschoolers (Landry et al., 2008). It was also hypothesized that, maternal maintaining behaviors during play would be associated with child outcomes. In the literature, maternal maintaining behaviors represent the mother's ability to support her child's developing skills, as she is not requiring the child to shift focus (Tomasello & Farrar, 1986). By maintaining the child's focus, she is allowing the child to explore and perhaps investigate one particular game or toy in depth, rather than (re)directing the child's play and encouraging the child to engage new and different games. This kind of maternal support of the child's attention has been found to facilitate higher levels of self-regulation and learning (Tomasello & Farrar, 1986; Vygotsky, 1978).

Other maternal behaviors that were hypothesized to be negative, specifically redirecting and disengaged, were not found to be inversely associated with any child outcomes either. Maternal redirecting during play requires the child to shift tasks rather than continue to explore a fewer number of tasks in more detail. Maternal behavior that has more redirecting, rather than maintaining, during play has been found to be an indicator of mothers who are less responsive during play (Landry et al., 2008). In

addition, maternal disengagement during play may indicate poor maternal ability to understand what her child needs due or an inability to engage with her child well, which was hypothesized to have a negative effect on child outcomes. However, maternal behaviors of introduce, redirect, and disengage during play were not found to relate to any child outcomes.

This lack of findings may be due to a number of reasons. One reason is the current study's relatively small sample size ($N = 78$). Another reason may be due to how these maternal behaviors were operationalized. Beyond maintain, the other positive maternal behavior, introduce, was not found to be associated with any child developmental outcomes. While this is a positive interactive behavior that may indicate that the mother understands that her child is not currently engaged and may need some help initiating play, often this behavior only occurred at the very beginning of a play session. Therefore, the lack of findings between introduce and child outcomes may be due to the relative infrequency of the introduce code (occurred on average once in one quarter of all dyads), as the child needed to be completely disengaged from anything for this maternal behavior to be coded. In the context of child developmental outcomes, no associations were found between the two negative maternal behaviors, redirect and disengaged, with child developmental outcomes. The lack of associations may indicate that these behaviors are not necessarily negative or do not have a detrimental impact on the child's development, as hypothesized. In addition, disengaged was a relatively infrequent code and only occurred once on average in one quarter of all dyads.

One consideration in interpreting our results for hypotheses one and two, investigating associations between positive (introduce and maintain) and negative

(redirect and disengage) attention directing behaviors and child developmental outcomes, is that maternal attention directing behaviors were not confined to a specific mode of communication in the current study, meaning that these behaviors were neither specifically designated as verbal or nonverbal. *Specific* maternal behaviors and modes, such as behaviors within the verbal domain, have been studied and found to be associated with child verbal abilities. One example of a specific behavior and mode is verbal scaffolding, which is a verbal prompt that the mother gives the child when directing his or her attention towards activities or objects (Landry et al., 2002). Verbal scaffolding statements are divided into types of verbal statements such as features and descriptors. This kind of rich language is thought to provide the foundation for the child to develop problem-solving, attentional, linguistic and cognitive skills (Smith, Landry, & Swank, 2000). This behavior focuses on a specific domain of maternal behavior and has been shown to foster specific child behaviors such as verbally laden executive functioning and verbal abilities (Hammond, Muller, Carpendale, Bibok, & Liebermann-Finestone, 2012). In comparison to the verbal scaffolding coding, the interactive behavior schema used in this study does not assess for quality or richness of behavior, just presence or absence of a given maternal behavior. Therefore, these codes may not have been specific and sensitive enough to capture subtle differences. In addition, the current study's maternal interactive behaviors are not dyadic and therefore do not take into account what the child is doing in response to the mother. In other words, the mothers' behavior was evaluated as introduce, maintain, redirect, or disengaged during play, but the maternal codes do not account for the child's interest level or engagement in the play with mom. For example, if a mother continued to maintain play with a toy or game, she was coded as maintain

even if her child lost interest and pursued play on his or her own. Therefore, this limitation was addressed by creating a composite measure, the dyad engagement score, that took into account maternal maintain and amount of time that child spent pursuing play without maternal involvement. However, the dyad engagement measure was found to have the same associations as the maintain code, which occurred when the mother was facilitating the child's active attention, and indicates that the dyad engagement score is not more sensitive than the other maternal codes (introduce, maintain, redirect, and disengage).

A secondary aim of this study was to understand the associations among maternal, depressive symptoms, perception of resources, and interactive behaviors. In the current study, we found that the number of times mothers introduced new activities as well as the total time spent introducing new activities were negatively correlated with maternal depressive symptoms. This finding means that mothers who reported fewer depressive symptoms were more likely to introduce new activities during play when the child was not engaged in another task. This type of maternal behavior may indicate that the mother was attuned to her child's needs. Previous studies suggest that symptoms of depression are relatively common in mothers of young children, and mothers of children born VLBW endorse even more depressive symptoms than mothers of children born NBW (Howe et al., 2014). In other studies, parents who report more depressive symptoms have relatively poorer quality interactive behaviors (Singer et al., 1996), fewer maintaining behaviors (Landry et al., 2002), and more disengagement from the child during play (Lovejoy et al., 2000). In addition, attending to and maintaining a child's focus of attention with objects or play, rather than redirecting to another task, is an integral part of

responsive parenting for preschool age children (Landry, Smith, Swank & Guttentag, 2008).

We also found that the number of times mothers were disengaged as well as total time spent disengaged were inversely correlated with maternal perception of resources. This finding means that mothers who reported fewer resources available were more likely to be disengaged during play. The literature suggests that parents who have a perception of limited resources and support from their community are more likely to have worse quality of parent-child interaction (Choe et al., 2013). These parents may be preoccupied with how to provide their family with basic needs like food and housing and are therefore unable to engage fully with their child during play (Segretin et al., 2014). Another consideration is that difficulties related to depression may be influencing their engagement, as increased maternal social support has been found to reduce likelihood of depression in new mothers of children born VLBW (McManus & Poehlman, 2012).

A tertiary goal of the current study was to compare Hispanic, Caucasian, and Native American mothers' amount of redirecting during play. Prior research suggests that cultural and socioeconomic differences should be taken into account when investigating parent-child interactions and child developmental outcomes (Gauvain, 1995). When participants were separated by ethnic group, there were no significant differences in maternal redirecting behaviors during play between Caucasian, Hispanic, and Native American mothers. Although not statistically significant in the initial ANOVA, Caucasian mothers used the most number of redirecting behaviors and Native American mothers used the least number of redirecting behaviors during play. Our finding that Hispanic moms did not use more redirecting behaviors is not consistent with

past research which suggests that Hispanic mothers rather than the child typically control and direct the play. In comparison, Caucasian mothers tend to rely on praise and verbal inquiries during play (Zayas & Solari, 1994).

In the current study, redirecting behavior encompassed maternal behavior that was intrusive, such as mothers directing the child to another task when they were already actively engaged with a toy or game, and non-intrusive, such as mothers building on and moving along a pre-existing game (e.g., collecting grocery items and then redirecting to paying for groceries). In addition, these codes did not distinguish between successful redirects, when the child changed the focus of play based on the mother's redirection, and unsuccessful redirects. The codes also did not distinguish between subtle redirects, for example if the redirect moved play from one part of a game to the next, or a total change in focus of play.

Regardless of some of these methodological issues, overall, more directive maternal behavior, which includes some (but not all) instances of redirecting, appears to oppose cultural parenting goals of Caucasians (Harwood et al., 2009) and has been found to be negatively associated with parenting that is responsive and sensitive in Caucasian parent-child dyads (Hobson, Crandell, Patrick, Garcia Perez, & Lee, 2004; Moore, Saylor, & Boyce, 1998). Thus, our finding of Caucasian mothers using more redirecting behaviors on average compared to Hispanic mothers is in contrast to the extant literature.

Prior studies have found that Hispanic mothers utilize more visual cues, directives, and modeling behaviors compared to Caucasian mothers (Zayas & Solari, 1994). However, the current study found no ethnic differences between Hispanic and Caucasian mothers. In a study of toddlers born VLBW, Spanish speaking Hispanic and Native

American mothers used less flexibility, which was the degree to which the mother allowed the child to direct the activity and supported the child's exploration of the environment and toys, during play compared to English speaking Hispanic and Caucasian mothers during play (Erickson et al., 2012). It is interesting to note that, in this prior study, differential associations between maternal flexibility and child play sophistication were found based on ethnicity. Although the current study did not look at flexibility specifically, more maternal redirecting during play indicates more mother-led play, which indicates a less flexible interactive style.

Native American families have been underrepresented in the literature on parenting behaviors and child developmental outcomes (Bernstein, Harris, Long, Iida, & Hans, 2005). In the current study, although the difference was not statistically significant, descriptively, Native American mothers used the fewest number of redirecting behaviors compared to Hispanic and Caucasian mothers. Post hoc testing showed that, while not significant, Caucasian mothers used more redirecting behaviors than Native American mothers. Research on parenting behaviors in Native Americans has found that the behaviors tend to be more focused on the child, with an emphasis on the child learning by example and observation of their elders (MacPhee, Fritz, & Miller-Heyl, 1996). This kind of interactive style is consistent with fewer redirecting behaviors, as the child would be raised from an early age to be quieter and follow his or her parent's lead, with less of a tendency for child directed play.

Limitations and Future Directions

One notable limitation of the current research study is that the sample size, and specifically the small sample size of each racial and ethnic group, limits the ability to find

significant associations when they are present, and limits the generalizability of the current findings. In particular, there were fewer Native American mother-child dyads compared to Hispanic and Caucasian dyads, and too few African American dyads to (n = 5) to include in ethnic group comparisons. Future research should include a larger sample size with more representation from ethnic and racial minorities.

A NBW group was not included in the current study so that the focus of the current study could be on associations among VLBW participants, who are more at risk for poorer developmental outcomes and more sensitive to quality of parenting than NBW children. However, inclusion of a NBW group could help to determine if the two groups differ in their associations between maternal interactive behaviors during play and child developmental outcomes. Any birth weight group differences may help inform more specialized interventions for the VLBW group.

Another limitation of the current study includes how maternal attention directing behaviors were measured (Landry et al., 1998). Although these behaviors were not explicitly designated as a specific mode of communication, such as the verbal or nonverbal domain, these behaviors were typically coded based on verbal behavior, as nonverbal behavior was more difficult to differentiate based on how these codes were operationalized. These codes could be refined and include domain-specific kinds of behavior, such as verbal maintain and nonverbal maintain. In addition, it may be informative to include codes that are inherently dyadic to assess for mutual engagement.

In the current study, we relied on maternal self-reports of depressive symptoms rather than using an interview or a diagnosis of Major Depressive Disorder. We also used a maternal self-report of her perception of available resources rather than asking her

specific questions about available resources and assessing her access with an objective measure. Although self-report measures are a time- and cost-efficient way to assess characteristics of interest, these measures also depend on the mother's ability to have insight into her situation, her willingness to reveal any vulnerabilities, and may be confounded by other variables that are not of interest.

In addition, only mothers were included in the current study. Research on parent-child interactions typically focuses on the mother, as mothers have been designated as the primary caregiver. As a result, research on father-child interactions is limited. However, it is important to understand the larger family context that the child is raised in to have better targeted interventions. Future research could include one video with the mother and one video with father to look at any differential associations and have father-specific recommendations.

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